

REMARKS

Claims 33 to 72 are pending after this Amendment.

Previously withdrawn claims 1 to 32 are cancelled. Applicants reserve the right to assert these claims in a divisional application.

Claims 68 to 72 are new.

Compliance with 35 U.S.C. §112

The Office Action alleges that claims 33 to 59 are indefinite for reciting “supersaturation ratio”. The Applicants submit that the inclusion of supersaturation ratio does not render the claims indefinite. Supersaturation ratio is defined in the specification (see paragraph [0032] for example).

Claim 33, as amended, recites “controlling a supersaturation ratio of struvite, a struvite analog, or a phosphate compound in the harvesting section to have a value within a desired range, wherein controlling the supersaturation ratio is performed at least in part by controlling a recycling ratio of a rate at which wastewater is recycled into the column to a total rate at which wastewater is being introduced into the column”. The Applicants submit that this text sets out what is required by this part of the claim and is in compliance with the requirements of 35 U.S.C. §112.

The Applicants submit that this fully addresses the rejection of claims 33 to 59 under 35 U.S.C. §112.

Compliance with 35 U.S.C. §102

The Office Action alleges that claims 60 to 63 are anticipated by Bowers (US 6994782). The Applicants submit that claims 60 to 63, as amended, distinguish Bowers at least because they recite “recycling wastewater which has passed through the column”. The Examiner has indicated that Bowers fails to disclose such recycling. This is correct as

Bowers is understood by the Applicants. Therefore, claims 60 to 63 are submitted to not be anticipated by Bowers.

Compliance with 35 U.S.C. §103

The Office Action alleges that claims 33 to 59 are obvious in light of the combination of Bowers and LAGEP. Essentially, the Examiner argues that a person of skill in the art would be motivated to modify Bowers by adding recycling as disclosed by LAGEP and that, if this were done, one would arrive at the invention claimed in this application.

The Applicants submit that independent claims 33 and 60 are not obvious in light of the alleged Bowers/LAGEP combination.

One reason is that claims 33 and 60, as amended, each recite that a supersaturation ratio is controlled at least in part by “controlling a recycling ratio of a rate at which wastewater is recycled into the column to a total rate at which wastewater is being introduced into the column”. Bowers, as understood, does not disclose recycling at all. The descriptions of various crystallizers provided in LAGEP, as understood, do not provide this feature either. Specifically, as understood:

- LAGEP section 3.1.1 (page 16) describes a batch mode pilot unit including a column and a recirculation pump (5). Operating in batch mode, the entire flow through the column would apparently be recirculated process fluid.
- LAGEP section 3.1.2 (page 17) describes a continuous mode pilot unit. LAGEP states that the recycle flow rate remained constant.
- LAGEP section 3.5.2 (page 22) does not disclose controlling or even varying a recycling ratio. In section 3.5.1 it is stated that the influent flow rate must be held constant.
- LAGEP section 3.6 (pages 23-24) Figure 9 describes a batch process in which there is presumably no mixing of recycled and freshly-introduced wastewater.
- LAGEP section 3.7 (page 25) Figure 10 describes a continuous process which includes recirculating process fluid but does not disclose controlling or even varying a recycling ratio.

Therefore, the combination of Bowers and LAGEP fails to provide methods having all of the features of independent claims 33 and 60.

Further, LAGEP provides various motivations for recirculation including:

- Maintaining a flow rate to fluidize a bed (section 3.1.2);
- Enhancing crystallization efficiency (section 3.5.2);
- Allowing for long FBR contact time with a relatively small reactor (section 3.6, p. 25)

LAGEP, as understood, does not disclose or suggest that a supersaturation ratio may be controlled by controlling a recycling ratio, as claimed.

Further, Bowers, as understood, implicitly teaches away from providing recirculation. Bowers concludes that the best results are obtained at the lowest flow rates (e.g. col 78, ln. 21). Note that recirculation necessarily increases the flow rate through a column for a constant inflow of wastewater. Bowers explicitly considers the results of an extensive literature review and batch tests in selecting a design for a crystalizer system (col. 26, ln. 46-8) but does not mention anywhere that the crystalizer system could provide recirculation.

For at least these reasons, independent claims 33 and 60 are submitted to be patentable over the combination of Bowers and LAGEP. The remaining claims all depend, directly or indirectly, from one of claims 33 and 60 and are submitted to be patentable over the cited references for at least this reason.

The dependent claims are submitted to further distinguish the cited Bowers/LAGEP combination.

Claim 36 recites “maintaining a supersaturation ratio in the range of 2 to 5 within the harvesting section”. In the Bowers apparatus, product is collected in a product collector (22) that is not part of the flow path within main chamber (12) (see Figure 11; col. 27, ln. 4-9; and the description of removing product at col. 79, ln. 60 to col. 80, ln. 21). Product collector (22) may not even contain liquid while the apparatus is operating (see col. 80, ln. 2). There is no reason for Bowers to maintain supersaturation conditions in product collector (22) since particles are only received in product collector (22) for the purpose of removing those particles from the Bowers system.

Further, the Applicants submit that Bowers does not disclose a method which involves controlling a supersaturation ratio to be in the range of 2 to 5, as claimed in claim 38. Claims 39, 68, and 69 are submitted to distinguish the cited combination for the same reason.

Claims 48, 52 and 64 recite "maintaining an average upward flow velocity of at least 400 cm/min within the harvesting section". As noted above, Bowers' product collector (22) is not part of the flow path in the Bowers apparatus. The Bowers apparatus cannot maintain a flow in product collector (22).

The Office Action suggested that the features of claims 55 and 56 are found in LAGEP. Claims 55 and 56 have been amended to be more specific. Claim 55, as amended, recites that the recycled wastewater passes through a clarifier before being mixed with incoming wastewater. Claim 56, as amended, recites that the recycled wastewater passes through an air stripper before being mixed with incoming wastewater. LAGEP, as understood, does not disclose these features. Specifically:

- LAGEP section 3.1.1 discloses a batch mode process in which there would be no incoming wastewater during treatment;
- LAGEP section 3.1.2 discloses a continuous-mode process in which recycled process liquid mixes with incoming process liquid in a stripper (see Fig. 4);
- LAGEP section 3.1.3 discloses a process in which recycled process liquid mixes with incoming process liquid in a stripper;
- LAGEP section 3.5.2 discloses recycled process liquid mixing with incoming process liquid at a pumpwell; and
- LAGEP section 3.7 discloses recycled process liquid mixing with influent upstream from a pH adjustment tank.

The Applicants submit that none of these systems described in LAGEP provides the features of claim 55 or 56.

Claims 57 to 59 recite various pellet retention times, the shortest of which is four days. This feature is not disclosed by Bowers. Bowers' test runs using the field-scale system lasted only up to 29.5 h (col. 69, ln. 17). The laboratory-scale system could not be operated for more than 4 hours without shutting down the system to remove product (col. 28, ln. 35). The Applicants submit that nothing in Bowers discloses or suggests a pellet retention times of four days or

more. Applicants submit that the pellet retention times claimed in claims 57 to 59 are qualitatively different from the much shorter times suggested by Bowers. The LAGEP materials, as understood, fail to remedy this deficiency.

New Claims

New claims 68 to 72 are submitted to be fully supported by the application, as filed.

Conclusion

For at least the reasons above, the Applicants submit that all pending claims are now in condition for allowance. Reconsideration and allowance of this application are respectfully requested. The Examiner is respectfully invited to contact the undersigned by telephone in the event that this amendment does not fully resolve all outstanding issues.

Respectfully submitted,

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